* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the laminating voltage metering device which carries out insulating measurement of each voltage of the voltage source by which the series connection was carried out.
[0002]
[Description of the Prior Art] The high power power supply of hundreds V, such as an electric vehicle, carries out the series connection of many rechargeable batteries like a nickel hydrogen battery, and is constituted. The cell by which the series connection was carried out needs to supervise the condition of the capacity of each cell for charge-and-discharge control. Although the total voltage of 288V is specifically obtained by the serial cell of 240 cels, since it is difficult in amount of resources, supervising each cell has the example which considers as one module in ten cel, and is measuring the module unit for every 24 modules, i.e., voltage. (Refer to JP,8-1402044,A) In the electric vehicle, the high-tension system is insulated from the chassis for safety. On the other hand, since the chassis of the processor which controls charge and discharge is a reference potential, the voltage of said cell needs to be measured in insulation. It had the insulating circuit unit which includes an operational amplifier, an AD converter, a photograph coupler, a power supply, etc. for each module of every in the aforementioned example, and was very complicated.
[0003] The premature start capacitor circuit is known as a method which measures the output voltage of a sensor etc. in insulation. The example of a configuration of the conventional multiplexer by the premature start capacitor method (refer to JP,9-1617,A) is shown in drawing 13. The voltage of the voltage sources 20, 30, and 40 of a sensor etc. is charged at capacitors 22, 32, and 42 by closing switches 21, 31, and 41, where switches 23, 33, and 43 are opened, respectively. Next, the terminal voltage of capacitors 22, 32, and 42 is measured by AD converter 24 by scanning switches 23, 33, and 43 sequentially, where switches 21, 31, and 41 are opened, respectively (multiplexer). The insulation of each voltage source and a measurement circuit is secured with the phase relation of such each switching.

[0004]
[Problem(s) to be Solved by the Invention] A circuit will become quite easy if the circuitry of the premature start capacitor method of drawing 12 is taken to measurement of the module voltage of the cell of the electric vehicle explained by the Prior art. However, the further improvement is required for no less than a total of 96 pieces using the insulating actuation mold analog switch element of expensive high pressure-proofing to the module of 24 in fields, such as cost, size, and reliability.
[0005] This invention aims at simplifying the configuration of the conventional laminating voltage metering device further.
[0006]
[Means for Solving the Problem] With a voltage element child of an individual (N+1) connected to a voltage source of N individual to which the series connection of this invention was carried out in order

to solve this technical problem A capacitor and the first multiplexer which connects said odd-numbered voltage element child to one terminal of said capacitor selectively, The 2nd multiplexer which connects said even-numbered voltage element child to an other-end child of said capacitor selectively, It has a voltage measurement circuit, a sample switch which connects an ends child of said capacitor to said voltage measurement circuit, and a polarity correction means to arrange the detection voltage polarity of said odd-numbered voltage source and said even-numbered voltage source.

[0007]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained using drawing 12 from drawing 1 .

[0008] (Gestalt 1 of operation) Drawing 1 shows the configuration of the laminating voltage metering device by the gestalt of 1 operation of this invention, and explains the number of voltage sources (N) as five pieces. The voltage sources V1-V5 by which the series connection was carried out are connected to a capacitor 3 from the voltage element children T1-T6 via the first multiplexer 1 which consists of switches S1, S3, and S5 and a switch S2, S4, and the 2nd multiplexer 2 that consists of S6, and the capacitor 3 is further connected to the voltage measurement circuit 5 via the sample switch 4 which consists of Switches 4a and 4b.

[0009] Drawing 2 shows the closing motion timing of each switch for explaining actuation of the example of this invention, and explains actuation of drawing 1 based on drawing 2 . If switches S1 and S2 are closed in a period P1 on the basis of the condition of having opened and each switching device will close the sample switch 4 after a capacitor 3 charges and then the voltage of a voltage source V1 opens switches S1 and S2, the charge voltage of a capacitor 3, i.e., the voltage of a voltage source V1, will be inputted into the voltage measurement circuit 5. Since multiplexers 1 and 2 and the sample switch 4 do not close simultaneously, it is measured by a voltage source V and voltage in insulation, noting that the insulation is maintained with the actuation circuit of each switch and the contact of a switch being natural. the same -- a period P2 -- switches S2 and S3 -- Period P -- three S3 and S4 -- ** -- the multiplexer is carried out to the condition to say one by one.

[0010] What it should be careful of in drawing 1 here is the voltage of the even-numbered voltage source inverting to the odd-numbered voltage source, and inputted into the voltage measurement circuit 5. One example of the polarity correction means 6 for this is shown in drawing 3 . The role which arranges the voltage polarity inputted into the AD converter of the voltage measurement circuit 5 with the absolute-value circuit known with the sufficient polarity correction means 6 is carried out, and it is effective to the voltage source V of a unipolar like a cell. The polarity correction means 6 may be such an analog circuit not the digital circuit which disregards the polar output bit of the AD converter of a two-poles input.

[0011] (Gestalt 2 of operation) Drawing 4 is another example of the polarity correction means 6 of this invention, and it is the configuration of having added the inversion switches 4c and 4d to the sample switch 4 of drawing 1 , and Switches 4a and 4b are opened and closed to the timing of SSP of drawing 2 , Switches 4c and 4d are opened and closed to the timing of SSN, and polarity correction is performed.

[0012] (Gestalt 3 of operation) Drawing 5 is still more nearly another example of the polarity correction means of this invention, and the polarity correction means 6 is the polar selecting switch 7 formed in front of the capacitor 3. Switches 7a and 7b are opened and closed to the timing of MUP of drawing 2 , Switches 7c and 7d are opened and closed to the timing of MUN, and polarity correction is performed. In this case, compared with a front example, a capacitor 5 has the feature which can be managed with the object for unipolars to the unipolar voltage source V.

[0013] (Gestalt 4 of operation) Drawing 6 be drawing explaining the common mode error in voltage measurement, the voltage source V (in drawing, it be consider as Zero Volt) have common mode voltage En to the reference potential (touch-down potential in drawing) of the voltage measurement circuit 5, the terminal voltage of a capacitor 3 become Zero Volt in close actuation of multiplexers 1 and 2, and after it open multiplexers 1 and 2, it show the condition closed the sample switch 4. The low solid state switch of on resistance has the comparatively large parasitic capacitance at the time of OFF, and as

shown in drawing, the switches S1-S6 of an OFF state are capacitors, and can express the switches 4a and 4b of an ON state by resistance. Just before the sample switch 4 closes, the potential of the ends child of a capacitor 3 is En, respectively, and the charge stored in the off capacity of each switches S1-S6 is zero. Then, if a sample switch is closed, the potential of the ends child of a capacitor 3 will carry out change which goes to touch-down potential. The leakage current Ia and Ib accompanying migration of the charge to the off capacity of each switches S1-S6 occurs in the meantime. Although Current Ia and Ib is the same value in contrast, in the voltage measurement circuit 5 shown in drawing 6 , the flowing path is unsymmetrical and Current Ia falls to touch-down potential via a capacitor 3. Offset voltage occurs to a capacitor 3 under this effect, and it becomes the factor of a measurement error. This common mode error was a problem produced by the difference in potential of a voltage source own [not only by the outpatient department noise which rode on the insulated voltage source V but the original series connection / each], and was large by the juxtaposition off capacity of the switch of a large number which constitute a multiplexer from a configuration which measures many especially voltage sources. [of the problem]

[0014] Drawing 7 showed 1 operation gestalt of this invention for reducing a common mode error, and has formed the switch 8 opened and closed to the timing of MUB of drawing 2 between the multiplexer 1 and the capacitor 3. In the case of 24 module voltage sources shown in the conventional example, since the juxtaposition OFF capacity of 13 pieces of a multiplexer 1 becomes the OFF capacity and the serial which are one piece of a switch 8, a common mode error can be reduced to about 1/13.

[0015] (Gestalt 5 of operation) Drawing 8 showed another operation gestalt of this invention for reducing a common mode error, and the voltage measurement circuit 5 is a difference input mold, and it has formed the sample switch 4 and the switch 9 which are opened and closed to the same timing between the midpoint and touch-down potential while it constitutes the capacitor 3 in drawing 1 from two series capacitors 3a and 3b. The leakage current Ia and Ib generated like explanation by drawing 6 falls to touch-down potential through a switch 9 via Capacitors 3a and 3b, respectively. Leakage current Ia makes capacitor 3a, as for leakage current Ib, generate negative offset voltage for positive offset voltage in capacitor 3b, respectively in the case of the sense of the current shown in drawing 8 . Since such offset voltage has an equal absolute value and is canceled by the contrast nature of a circuit in the differential property of the voltage measurement circuit 5, a common mode error is not generated theoretically.

[0016] (Gestalt 6 of operation) Drawing 9 showed another operation gestalt of this invention for reducing a common mode error further, and has formed the switches 8a and 8b further opened and closed to the timing of MUB of drawing 2 between multiplexers 1 and 2 and Capacitors 3a and 3b to the configuration of drawing 8 , respectively. Although the contrast nature of the circuit in explanation of drawing 8 is involved in the contrast nature of the juxtaposition OFF capacity value of multiplexers 1 and 2, and the capacity value of Capacitors 3a and 3b, respectively, since there is variation in actual components, a cancellation error remains. In order to reduce a cancellation error, a best policy reduces the leakage current which becomes a cause in circuitry rather than raising the precision of the components itself. The common mode error generated with the practical configuration of drawing 8 in the same effect as the switch 8 in drawing 7 can be further reduced by forming Switches 8a and 8b.

[0017] (Gestalt 7 of operation) 1 operation gestalt of this invention for drawing 10 to measure the sum total voltage by which the series connection was carried out with each voltage of a voltage source V -- being shown -- the configuration of the laminating voltage metering device of drawing 1 -- in addition, it is considering as the configuration which leads the voltage of the ends of the voltage source V by which the series connection was carried out to a resistance-type potential divider 11 through a switch 10, and carries out a multiplexer with a switch 12 and a switch S6. If the division ratio of a resistance-type potential divider 11 is taken to N:1, convenience on a measurement range is good, and power-saving can be achieved by changing a switch 10 into an open condition except the time of measurement.

[0018] (Gestalt 8 of operation) 1 operation gestalt of this invention to which drawing 11 can reduce the effect of a RF noise -- being shown -- the configuration of drawing 1 -- in addition, the resistor 13 is formed between the multiplexer 1 and the capacitor 3. Most loads of the high power layer built cell

power supply which are the main objects for utilization of this invention are inverter equipment which drives a motor and a lighting system. In this inverter system, pulse noises with the steep many phases of a repeat several kHz or more are scattered, and it appears also in the detection voltage of a cell through the load current. A cure is required in order to give an error to a required measurement precision, if track hold of the detection voltage is carried out to a capacitor 3 by multiplexers 1 and 3 including this pulse noise. The resistor 13 of drawing 11 gives the time constant of high frequency response reduction to a capacitor 3. If a resistor is a front [capacitor / 3], although it is good anywhere, there are few numbers and it can be managed with this location. What is necessary is just to prepare a resistor similarly between a multiplexer 2 and a capacitor 3, when using a circuit as a contrast target.
[0019] (Gestalt 9 of operation) The example of the suitable switching device for operation of this invention is shown in drawing 12. The switching device of a configuration of opening and closing an MOS transistor through a photoelectric element 15 with the light of this LED14 is excellent in the optical insulation effect with a driving side, the switch property of high off resisting pressure and low on resistance, etc., and since the high off capacity which is a defect can be coped with by this invention, its practicability is high.
[0020]
[Effect of the Invention] According to this invention, the remarkable effect that the laminating voltmeter side equipment in which insulating measurement of high degree of accuracy is possible is realizable by very simple circuitry is acquired as mentioned above.

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CLAIMS

[Claim(s)]
[Claim 1] A laminating voltage metering device which is equipped with the following, and is characterized by measuring each voltage of said voltage source by repeating actuation which opens said multiplexer and closes said sample switch after choosing a desired voltage source by said multiplexer, where said sample switch is opened. A voltage element child of an individual (N+1) connected to a voltage source of N individual by which the series connection was carried out A capacitor The first multiplexer which connects said odd-numbered voltage element child to one terminal of said capacitor selectively A polarity correction means to arrange the detection voltage polarity of the 2nd multiplexer which connects said even-numbered voltage element child to an other-end child of said capacitor selectively, a voltage measurement circuit, a sample switch which connects an ends child of said capacitor to said voltage measurement circuit, said odd-numbered voltage source, and said even-numbered voltage source
[Claim 2] A laminating voltage metering device according to claim 1 whose polarity correction means is an absolute-value circuit.
[Claim 3] A laminating voltage metering device according to claim 1 whose polarity correction means is the sample switch which gave a polar optional feature.
[Claim 4] A laminating voltage metering device according to claim 1 which is the polar selecting switch opened and closed to the timing as a multiplexer and a multiplexer prepared between capacitors that a polarity correction means is the same.
[Claim 5] A laminating voltage metering device according to claim 1 equipped with a switch opened and closed to the same timing as a multiplexer between a multiplexer and a capacitor.
[Claim 6] A laminating voltage metering device according to claim 1 which a capacitor consists of two capacitor elements by which the series connection was carried out, is equipped with a sample switch and a switch which are opened and closed to same timing between those medium nodes and a reference potential of a voltage measurement circuit, and is characterized by a voltage measurement circuit being a difference input mold.
[Claim 7] A laminating voltage metering device according to claim 6 equipped with one pair of switches opened and closed to the same timing as a multiplexer between a multiplexer and a capacitor.
[Claim 8] A laminating voltage metering device according to claim 1 characterized by having a multiplexer which incorporates output voltage of a potentiometer which presses voltage of ends of a voltage source of N individual by which the series connection was carried out a resisted part, and said potentiometer.
[Claim 9] A laminating voltage metering device [equipped with a switch which separates a circuit between a voltage source and a potentiometer when a partial pressure is unnecessary] according to claim 8.
[Claim 10] A laminating voltage metering device according to claim 1 equipped with a resistor between a multiplexer and a capacitor.
[Claim 11] A laminating voltage metering device given in any of claims 1-10 characterized by being the

semiconductor relay element to which an analog switch element which constitutes equipment carries out optical insulation actuation of the gate of an MOS transistor they are.

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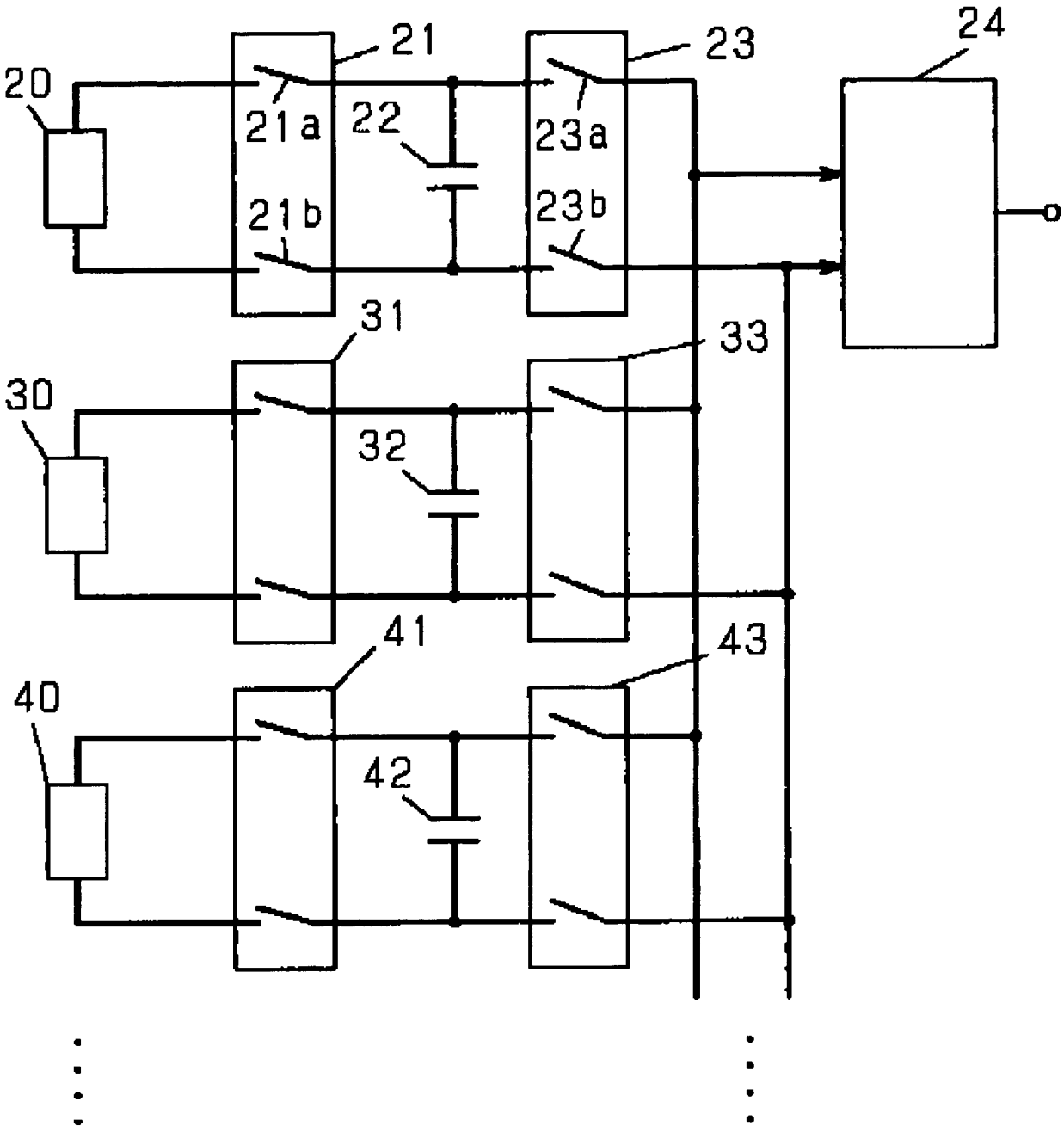
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